Impact Evaluation Design for Mozambique-MCA Land Project (Pillar III): Improving Site-Specific Access to Land Activity in Urban Areas

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By

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1. Overview of the Land Project

The Government of the Republic of Mozambique and the Millennium Challenge Corporation (MCC), on behalf of the United States Government, have signed a Compact Agreement (which entered into force on September 22, 2008) for a US $507 million grant to be implemented over a 5 year period. The overall objective of the proposed Program is to reduce poverty through economic growth in the four Northern Provinces of Mozambique (Niassa, Cabo Delgado, Nampula, and Zambézia). The Program involves crucially needed investments in water, sanitation, and transport infrastructure, land tenure security, agriculture, capacity building, and institutional strengthening.

The Land Tenure Services Project (or simply the *"Land Project"*) of the Mozambique MCA compact aims to establish more efficient and secure access to land by improving the policy and regulatory framework and helping beneficiaries meet their immediate needs for registered land rights and better access to land for investment. The Project's objectives are to: (i) increase the level and value of investment on land; (ii) increase access to land; (iii) reduce the costs associated with acquiring land user rights; and (iv) resolve and prevent conflicts over land. Investments are targeted to all four Northern Provinces, at all levels of administration – National, Provincial, and District / Municipal – and across a range of beneficiaries, including rural individual land holders, rural communities, urban land holders, and domestic and international investors.

The Land Project is comprised of three mutually reinforcing activity areas (or Pillars) with different geographic coverage as described below:

Pillar I--Policy Activity (all activities implemented at the **national level**): Support for an improved policy environment, including addressing implementation problems for the existing land law and engaging in regulatory review to improve upon it. Examples of activities include:

1. Development of a national land administration and needs assessment
2. Formation of Land Policy Consultative Forum that will provide technical and logistical support to monitor progress on land legislation
3. Broad campaign of public education, outreach and rising awareness of non-judicial dispute resolution methods
4. Expand program on legal and judicial training
5. Advisory services to DNTF

Pillar II--Capacity Building Activity: Building the institutional capacity to implement policies and provide quality public land-related services. Examples of activities under this Pillar include:

1. Professional development and training (**national level**)
2. Further development of LIMS (**national level**)

3. Technical Assistance to the upgrading of facilities (**4 Provincial** SPGCs and **12 selected district** land service office)
4. Technical Assistance for cadastral development in selected municipalities (**8 selected municipalities)**

Pillar III--Site Specific Activity: Facilitating access to land use by helping people and business with (i) clear information on land rights and access; (ii) resolution of conflict with more predictable and speedy resolution of land and commercial disputes – which in turn creates better conditions for investment and business development; and (iii) registering their grants of land use (land titles to long-term or perpetual-use rights). Examples of activities include:

1. Mapping and inventory exercise (all **12 selected districts and 8 municipalities**) and piloting an approach to area-wide registration of land rights in "Priority areas"; Streamlining investor and farmer access to land by making available simple informational tools and guidelines (**selected hotspot areas** within the 12 districts and 8 municipalities)
2. Support of Community Land Fund (iTC) (**3 provinces** –Zambezia, Nampula and Niassa)

Overall, the *Land Project* works on improving policy, upgrading the public land administration agencies (the title registry and cadastre), and facilitating site-specific land access. The three main pillars described above address concerns widely shared across the private sector, government, and civil society with solutions that bring together their diverse perspectives. Benefits from the Land Tenure Services Project are projected to accrue to (i) rural households; (ii) urban households; (iii) communities; and (iv) businesses and investors in the form of increased income, lower transaction costs, and increased investment opportunities.

2. Impact Evaluation of the Land Project: An Overview

As described above, the Land Project consists of three main pillar activities and several component activities that will be implemented at different levels of geo-political aggregation (i.e., national, provincial, district, municipal, priority/"hot spots" areas, etc.). Because of different geographic scale and diverse scope of activities across selected provinces, districts and municipalities, it is not possible to implement a rigorous impact evaluation of the Land Project as a whole. Thus, a multi-faceted evaluation approach is planned to assess the short- to medium term impacts of the Land Project across the three Project 'Pillars':

Pillar I and II: The coverage and scope of project activities under Pillars I and II (capacity building and policy monitoring) ranges from national to provincial to district/municipal level. Rigorous impact evaluation is not possible for these sets of activities because of their universal coverage.[1] Thus, impact of these activities (as a

[1] Note, however, that the site specific activities (rural and urban hotspots) are in a way a cumulative sum of all these activities to be implemented because they are the smallest unit of geographic area affected by all

cumulative whole) will be assessed using a 'before' and 'after' comparison of a nationally representative sample of households corresponding with the Trabalho Inquérito Agricola (TIA) surveys conducted in 2008 and planned to be conducted at the interval of three years. For impact evaluation purpose, an extended module on land will be added to TIA surveys to collect detailed plot level information on land ownership, land titling, functioning of land rental markets, land conflicts, land related investment and knowledge of land law. Data from 2008 and subsequent TIA surveys will be used to evaluate the impacts of Land Project macro-level interventions using econometric techniques.

Pillar III: Impact evaluation (IE) of the land project activities implemented under Pillar III will focus on "hotspot" issues in selected priority areas that results in registering or granting land use rights (i.e., land titles to long-term or perpetual-use rights) to individuals.[2] This document describes the impact evaluation design for Pillar III site specific activity planned in urban hotspot areas.[3]

3. Impact Evaluation Design of the Urban Hotspot Activities Under Pillar III of the Land Project

Overview of the activity being evaluated

A list of the eight municipalities and the selection criteria they meet for Land Project activities is given in Table 1. The priority areas (or *bairros*) identified for site specific activities within these eight municipalities are the smallest unit of project interventions of the Land Project in urban areas. As such, the impacts to be observed at the beneficiary level in these priority areas (or *bairros*) will be a cumulative sum of all the three pillar activities of the Land Project (i.e., policy, capacity building and site specific activities).

Project activities will be implemented with technical assistance from service providers such as CENACARTA, and the implementing partner (HTSPE) and cover following major activities:

a) The satellite mapping and inventory exercise
b) Capacity building of the local cadastral offices
c) Piloting a sound approach to area-wide registration of land rights

Activities under 'a' and 'b' are generic at the level of all selected 8 municipalities (i.e., cover all the bairros within the selected municipalities). However, activities under 'c' will be implemented only in selected priority bairros to address some hotspot issues related to

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the national, provincial, district and municipal level interventions (one built on the other). Thus in one sense, the impacts of these activities as a whole will be evaluated under the rigorous IEs of the hotspot areas described under Pillar III.

[2] Initially, there were plans to conduct rigorous IE of the community land fund project (iTC) under Pillar III. However, based on the design of the iTC project and given the vast and diverse issues to be potentially covered by iTC, it was not feasible to do a rigorous impact evaluation of this component of Pillar III.

[3] A separate impact evaluation design document will be developed for the rural hotspot activities when plans are finalized.

expansion, requalification and regularization (Annex 1). The purpose of this area-specific interventions in priority bairros is to pilot a sound approach to area-wide registration of land rights to individuals.

Table 1: Selection criteria met by the eight municipalities selected for Land Project activities in four Northern provinces

	Criterion 1	Criterion 2	Criterion 3	Criterion 4	Criterion 5	Criterion 6
Provincia da Zambézia						
Quelimane-cidade			x			x
Mocuba-cidade		x	x		x	x
Provincia de Nampula						
Monapo-Vila	x	x	x		x	x
Nampula-cidade	x		x		x	x
Provincia de C. Delgado						
Pemba-cidade	x	x			x	x
Mocimboa da Praia- vila	x	x				x
Provincia do Niassa						
Lichinga-cidade	x	x	x			x
Cuamba-cidade	x	x	x			x

Key for Criteria: 1 = high demand for DUATs; 2 = government priority; 3 = local technical capacity exists; 4 = surpport from other sources (financial and human); 5 = land use plans exist; 6 = high risk of land conflicts.

Geographic coverage of the IE

Given the time and resource constraint, it was not feasible to implement a rigorous IE study focused on all eight municipalities. The two municipal areas in the Province of Nampula--Monapo vila and Nampula city were selected for this rigorous impact evaluation of urban hotspot activities based on discussions with MCC/MCA and taking in to account the following criteria:

- Large numbers of bairros facing the same hotspot issue in a given municipality.
- Ability to identify comparison bairros to estimate the effects of the intervention in a rigorous and robust manner.
- Indication that project interventions in hotspot areas are planned earlier in MCA's 5-year implementation plan (to ensure enough time to observe outcomes and impacts).

The focus of the impact evaluation design described in this document is to assess the impact of the interventions targeted in priority bairros within Nampula city and Monapo Vila that have been identified under the hotspot issue of "requalification / regularization."[4] The geographic coverage includes four priority bairros in Nampula city and six priority bairros in Monapo vila (Table 2). These were selected and prioritized by the municipalities based on some set criteria and were outside the control/influence of the impact evaluation team.

[4] In other words, the hotspot issue of 'expansion' is not included in this evaluation design.

Table 2. Project intervention bairros for "hotspot" site specific activities under Pillar III

Nampula City	Monapo Vila
Muatala	Mucaca
Muhala – Sede	Mecutane
Mutauanha	Topelane
Namutequeliua	Moajem
	Boa Viajem
	Metropime

Research questions to be addressed by the IE

The goal of the intervention in the priority hotspot areas is to make the land administration units (i.e., the cadastral offices) in the selected municipality (in this case, Monapo vila and Nampula) more efficient and well-prepared in meeting client needs (i.e., put in place procedures/infrastructure to reduce time and cost for potential clients to obtain land title acquisition and cadastral surveys). The expected outcomes of this intervention are that this will increase the number of land users registering their lands and consequently increasing productive activities on those parcel of lands, and generating positive benefits in terms of increased income and economic growth in the region. The impact pathway hypothesized for this intervention is summarized in Table 3.

Initiatives to strengthen the property rights system as envisaged in Nampula city and Monapo Vila are generally designed to result in clearly defined rights that are enforceable, transferable, and of appropriate duration and scope. An improved system should lower land-transaction costs, lower the risk of expropriation or conflict, and increase tenure security. In the medium or longer term, the system should contribute to more efficient land uses due to improved productivity, increased investment, and the development of land markets. More productive land should result in higher asset/land values and higher incomes for property owners. Over time, as land and financial markets develop, formal land rights can also be used as collateral for loans.

Empirical studies suggest that impacts of land tenure projects vary considerably from country to country, depending on market development, financial institutions, legal frameworks, and beneficiary income. Land tenure reform has demonstrated impacts for economic growth that reaches the poor, but can have socially differentiated impacts that need to be measured and monitored. The purpose of the rigorous IE design for the two urban hotspot areas is to precisely measure and monitor these impacts. The key research questions guiding our design of the evaluation for urban hotspot activities in Nampula City and Monapo Vila are to evaluate the extent to which there is evidence of change in indicators of outcomes and impacts listed in Table 3.

Table 3. Impact pathway for area-specific intervention in priority bairros (i.e., to address the hotspot issue related to requalification/regularization)

Outputs	Outcome	Impact indicators	
		Immediate	Long-term
• Satellite images for the whole municipality • Digitized base maps for "priority areas" • Demarcated plots • Streamline system for land registration	• Reduced cost of providing services (land registration, titling) • Make the process simple, cost-effective and faster	• Reduced time to obtain land titles • Reduced cost of land title acquisition and cadastral surveys	• Increased number of registered property rights • Increased security of tenure→Reduced incidents of conflicts • Increased new commercial enterprises and activities • Increased level of investments on land parcels • More effective/productive land uses • Increased off-farm opportunities (labor mobility) • Increased access to formal credit (i.e., collateral effect)

Evaluation approach

By conducting an impact evaluation of the Land Project activities in two urban priority areas of Nampula and Monapo we intend to quantitatively estimate the change in the situation of the population due to the cumulative execution of all the activities under the Land Project (national, provincial, municipal and bairro levels). Thus we plan to compare the outcome of the targeted population in the presence of the program relative to the population's outcome if the program had not been implemented. In other words the basic principle that guides our approach is the comparison between situations "with" the project activities and "without" the project activities, also known as "treatment effect". This is as opposed to merely comparing beneficiaries "before" and "after" the project implementation (i.e. assessing the change in the situation of the beneficiary between before and after simply assessing the difference between participants and non-participants). Unfortunately, it is not possible to compare the same population in both the states--with and without the program exposure.

Practically, to address this problem, we estimate the average impact of the program on a group of individuals by comparing them to a similar group of individuals that are not directly affected by the program. Therefore, one critical step of any impact evaluation exercise is to establish a credible control group. A number of different empirical approaches have been employed to establish the credible comparison group (or control group). The most robust approach is randomization – in which the treatment group and control group are randomly selected from all the eligible sampling units (either clusters or individuals). A randomized experiment guarantees that there are no differences in the observed and unobserved characteristics (on average) between the treatment and control group and thus, a statistically significant difference in outcomes between the two groups can be attributed to the program.

However, given the fact that the intervention bairros (or the treatment bairros) listed in Table 2 were already selected by project implementers there was no scope of random assignment. Thus, we plan to adopt a non-experimental *comparison group difference-in-*

difference (DiD) design approach. Under this approach, units of observations (i.e., households) from the treatment bairros (i.e. all or a sub-set of bairros listed in Table 2 that receive project intervention before year 5) will be matched to units of observations from other bairros (that will not be receiving the project intervention by year 5) that are from the same municipalities and share similar hotspot issues and outcomes will be compared between these two groups before and after the intervention. Examining how outcomes change for households in the comparison group, who were not exposed to area-wide registration of land rights, will inform us about how those outcomes would have changed in the absence of the intervention for the treatment group.

The DiD approach essentially measures the difference of outcome indicators between participants (treatment group) and nonparticipants (comparison group) before and after program intervention. In the context of panel data (with a baseline survey and a follow up survey of the same households), DiD is a common and valid method to estimate the impact of an intervention if the assumption that unobserved heterogeneity is time invariant and uncorrelated with the treatment effect is satisfied. While the main advantage of DiD is its ability to allow for selection on unobserved factors, its assumption of constant selection bias over time may be unrealistic in practice.

Let Y be the outcome of interest (etc. land investment, land market participation, household income, off-farm employment, etc.). Our goal is to evaluate the impact of a specific intervention $\boldsymbol{T}$ (i.e., issue DUAT to urban residents) on Y after a time period 1. Specifically, we can achieve this evaluation through DiD as:

$$DD = E[Y_1^T - Y_0^T] - E[Y_1^C - Y_0^C] \qquad (1),$$

where the superscripts T and C refer to treatment and control households, respectively; the subscripts 1 and 0 refer to time period 1 (after the intervention) and time period 0 (the baseline period), respective; T=1 refers to Treatment group. The regression counterpart of (1) is the following:

$$Y_i = \alpha + \beta T_i + \gamma t + \delta(T_i * t) + \varepsilon_i \qquad (2)$$

Where T_i is the dummy to distinguish treatment group (T=1) from control groups (T=0), t is a time dummy (t=0 for before treatment and t=1 for after the treatment). In (2), we can further add other control variables ($\boldsymbol{X}$) to increase the efficiency of the estimation. DiD is widely used in impact evaluation of policy interventions especially when the experimental data are not available (see discussion by Duflo, Glennerster and Kremer 2007; Ravallion 2005). The DiD approach was also used by similar studies on land titling projects in other countries (Deininger et al. 2011, Di Tella 2007; Field 2007).

4. Identifying Comparison Communities and Data Collection Plan

There are two things needed to implement the DiD IE design:
1. Identification of treatment and comparison sites, and
2. Data collection from both treatment and comparison sites before and after intervention.

The prioritized bairros listed in Table 2 are the potential pool of treatment sites for this IE. The units of impact observation will be households. Thus, households within the boundary of these listed bairros serve as the treatment group. If the time line for implementing the interventions in prioritized hotspots was such that project implementer could have staggered the implementation across these bairros over time, ideally, we could have implemented a 'pipeline' design whereby the order of project intervention across prioritized bairros could have been randomized. In that scenario, bairros randomly assigned to receive intervention in the first year could have served as treatment and bairros randomly assigned to receive the intervention in year 5 could have served as control. However, based on the discussions with municipal staff and project implementing partners, it is clear that a pipeline design is not feasible for these two selected municipalities. The reason is that the intervention bairros have been already prioritized from among a pool of all potential bairros in the municipality, and in the case of Monapo they have been assigned a priority order.

Given this reality, we are using the following strategy in each of these two municipal areas to ensure we have sufficient number of comparison households to implement the DiD design.

For Nampula, the strategy is to select an additional bairro (Muahivire) that is facing the same hotspot issue but is not in the priority list. Baseline data will be collected from all five bairros—the four priority bairros and one non-intervention bairro. The plan is to over sample households in this non-intervention bairro (Muahivire) as it will serve as a comparison site for the IE. Any bairro that does not receive the intervention by Year 5 (before the follow-up survey), will also serve as an additional comparison site for the IE.[5]

For Monapo, we are following a similar strategy but the numbers are different. We have selected the following five bairros (which are all peri-urban) to serve as comparison bairros.[6] The bairros not selected as part of this IE design from Monapo Vila were all rural bairros.

Mulotine
Nachicuva
Naheruque

[5] Given the large size of each bairro in Nampula, it is likely that it may take more time to complete all the intervention activities in four bairros. If the interventions are undertaken in a sequence and it takes an average one year to complete one bairro, then this scenario is potentially possible.

[6] Ideally, we would have preferred an evaluation design that had a mix of urban and peri urban bairros in both the treatment and control sites. However, since the municipality has already selected priority bairros (which are all urban bairros) and the order in which they will be treated, we are left with only peri-urban bairros for control group.

Micolene
Nova Cuamba

In addition, if any of the seven priority bairros listed in Table 2 do not receive intervention before the follow-up survey planned in year 5, then that bairro will also serve as a comparison bairro.

Thus, the IE plan consists of conducting baseline and follow-up surveys in five bairros in Nampula (4 priority + 1 extra) and in 11 bairros in Monapo Vila (6 priority + 5 extra). All the bairros to be surveyed are listed in Table 4 along with some key characteristics based on 2007 census data.

Table 4. List of selected bairros for the impact evaluation design in Nampula ciudad and Monapo Vila: Main characteristic features[\a]

Selected Bairros for the IE design	Urban (U) / Peri Urban (PU) / Rural (R)	Priority (order) Given by municip-ality	Potential treatment or control sites	No. of total Enumer-ation Areas (EAs)	No. of HHs	Popul-ation (N)	% of hhs with farm income	% of HHs with TV	% of HHs with female head
Nampula:									
Muatala	U	Yes	Both	77	9731	45231	23.57	26	22
Muhala – Sede	U	Yes	Both	76	11380	59618	20.91	37	21
Mutauanha	U	Yes	Both	72	13438	62976	29.04	25	18
Namutequeliua	U	Yes	Both	51	9405	45154	26.12	20	22
Muahivire	U	No	Extra control	78	11052	49763	32.80	23	20
Total					55,006				
Monapo:									
Mucaca	PU	Yes (3)	Trtmt	9	1108	4392	39.98	6	25
Mecutane	U	Yes (4)	Trtmt	8	743	3549	55.45	14	31
Topelane	U	Yes (7)	Trtmt	7	676	2785	43.05	15	27
Moajem	U	Yes (8)	Trtmt	5	489	2395	47.44	17	26
Boa Viagem	U	Yes (9)	Trtmt	5	537	2486	44.69	20	21
Metoprime	U	Yes (10)	Trtmt	4	386	1773	67.36	14	27
Mulotine	PU	No	Cntrl	6	610	2925	54.59	17	34
Nachicuva	PU	No	Cntrl	21	2008	8142	47.06	6	25
Naheruque	PU	No	Cntrl	6	508	2164	27.36	5	23
Micolene	PU	No	Cntrl	8	477	2041	57.65	9	30
Nova Cuamba	PU	No	Cntrl	9	1355	5576	43.10	6	29
Total					8,897				

\a Characteristics and statistical data are based on the sample frame and results of the 2007 census. (Post-script: Data collection efforts prior to baseline survey to finalize the sampling frame and to identify a list of eligible households indicate that the sampling frame has deteriorated substantially over the last 4 years, especially in Monapo Vila, with a concomitant decline in population.This may be a consequence of migration of households from small urban areas to larger cities or movement to locations outside the frame with new settlements near roads, etc.

Sample size

The power of the design is the probability that, for a given effect size and a given statistical significance level, we will be able to reject the hypothesis of zero effect. Sample sizes, as well as other design choices, will affect the power of an experiment. To estimate the total sample size for this IE design, we treat Nampula city and Monapo Vila as two independent evaluations, but both addressing the same impact questions for similar interventions. For each of these two urban areas, we follow the steps described below (and elaborated in Table 5) to estimate the total sample size.

In step 1, we applied the power calculation based on a simple random sampling method using the formula in equation 3 to estimate the minimum required sample size for Nampula city and Monapo Vila based on the following parameter values: a power (k) of 80% (i.e., t_{1-k}=0.84), a significance level (α) of 0.10 ($t_{\alpha/2}$=1.65), and portion of subjects allocated to treatment group (P=0.5), and a standardized minimum detectable effect size (MDE), m=(MDE/σ) of 0.25.

$$n = \left[\frac{(t_{1-k} + t_{\alpha/2})^2}{m^2 * P(1-P)} \right] \qquad (3)$$

Equation (3) is basically the same equation (7) in Duflo et al. (2007). The only difference is that we use to solve for sample size rather than for MDE and the *m* in equation 3 is the standardized MDE (i.e., minimum detectatble effect size divided by standard deviation).

The estimated minimum sample size based on this formula and the given parameter values noted above came to 397 for each city (Table 5). Table 6 shows how the sample size would change under different parameter values to achieve the power of 90%. For example, the number would change to 413 if we change P to 0.6. Alternatively, with P=0.5, the sample size estimate is 501 if we change α to 0.05. The corresponding number of observations for α=0.10 (or 0.05) would further increase to 620 (or 780) if we set *m* at 0.2 instead of 0.25.

In reality, as a means of saving money, the simple random sampling is rarely used because it requires the researcher to sample across all geographic areas within the domain. Thus, cluster sampling is more common than a simple random sampling approach. In this IE design, we also plan to follow this practical approach and sample households from a sub-set of enumeration areas (EAs) within a given bairro. This cost saving measure, however, does reduce the confidence level of the estimates for a given sample size. This loss of effectiveness by the use of cluster sampling, instead of simple random sampling (SRS), is the **design effect,** defined as the ratio of the actual variance under the sampling method actually used, to the variance computed under the assumption of simple random sampling.

Table 5: Steps used in estimating the sample size for the IE design

Steps	Parameters	Nampula	Monapo Vila
1: Apply "Simple Random Sampling" method	Power (k) of 80%	80%	80%
	Significance level (α)	0.10	0.10
	Portion of subjects allocated to treatment group (P)	0.5	0.5
	Standardized minimum detectable effect size (MDE), m=(MDE/σ)	0.25	0.25
	Estimate of minimum sample size (SRS)	**397**	**397**
2: Adjust for the design effect	Design effect (DEFF)	2.0	2.0
	Effective sample size = SRS * DEFF	**794**	**794**
3: Adjust for attrition from baseline to follow-up survey	Attrition factor	**13%**	**11%**
	Adjusted sample size = Effective sample size * (1+ attrition rate)	897	881
	Sample Size (Rounded off)	**900**	**880**

Table 6: Sample size required to achieve the power of 80% under different parameter values

		(MDE/σ)=0.25		(MDE/σ)=0.20	
P	1-P	α=0.10	α=0.05	α=0.10	α=0.05
0.50	0.50	**397**	501	620	780
0.60	0.40	413	523	681	861
0.65	0.35	436	551	646	816
0.70	0.30	472	597	738	933

In general, using a cluster sample generally requires either a larger sample size than a simple random sampling or using a wider confidence interval. The design effect is used to determine how much larger the sample size or confidence interval needs to be. The main components of the design effect are the intraclass correlation, and the cluster sample sizes. Given the fact that we are potentially interested in many outcome variables in this IE design and the data requirement at the EA level from previous surveys to estimate the intraclass correlations for all the outcome indicators, which were not available to us, we used a simplistic approach of assuming the design effect to be 2.0. Most studies in the literature report a design effect in the range of 1 to 3[7] (Shackman 2001); so this assumption of a design effect = 2 is not unrealistic.

[7] Some studies also report design effects less than 1 and more than 3.

In second step, the estimated sample size from SRS was multiplied by the design effect (2.0) to get an effective sample size (Table 5). However, given the potential attrition rate for the longitudinal survey, in step 3 we increased the sample size for both the urban areas in the baseline survey by a factor of 13% for Nampula (which is more urbanized) and 11% for Monapo (which is peri-urban and more rural). The end result of all the three steps is an estimated total sample size of 900 households for Nampula city and 880 households for Monapo Vila (Table 5). These are the target sample size for the IE design in the two urban hotspot priority areas.

Sampling Method

Once the sample size is determined as described above, the actual selection of the sample of households is done as described below. Depending on the number of enumeration areas (EAs) (which are the primary sampling units in the context of Mozambique sampling frame) and the total sample size targeted for the survey (described above), the sampling method for this IE design will follow the following one- or two-stage sampling design (Table 6). The sampling frame for the purpose of this IE is defined as "households that have land in the given municipality."

Two-stage sampling design

For all the treatment and control bairros in Nampula city the following two-stage sampling design will be used: In stage one, we propose to randomly select 10 EAs for the 4 prioritized hotspot bairros and 20 EAs for the additional control bairro. This sample of 10 or 20 EAs will be selected within each bairro systematically with probability proportional to size, where measure of size is the number of households based on data from the Population Census of 2007.

In stage two, 15 households in each EA will be randomly selected which will give a total sample of 900 households in Nampula City (across both potential treatment and control bairros). The random selection of 15 households in each EA will be based on the 'table of random numbers' generated for potential size of the EAs ranging from 40 households to 450 households.

For one of the control bairros in Monapo Vila--Nachicuva, which has 21 EAs, this same two stage sampling process will be used, but with a different number of target EAs and households. In the first stage, 5 EAs will be selected in Nachicuva with probability proportional to size of the EAs (based on data from 2007 population census). In stage 2, 16 households will be selected from Nachicuva based on the 'table of random numbers' as described for Nampula city.

One-stage sampling design

For all the remaining 10 small Bairros in Monapo Vila that have less than 10 EAs we plan to adopt a one-stage sampling design to simplify the estimation procedures. The plan is to select 80 households from a list of all the households ordered by EAs in a given

bairro based on a method called 'systematic sampling with a random start'. With a one-stage random systematic selection of households from the list of households ordered by EA, the number of sample households selected in each EA would be proportional to the size of the EA, thus simplifying the estimation procedures.

Table 6. Number of EAs and households in each selected Bairros included in the baseline survey in Nampula ciudad and Monapo Vila

			Stage 1: Selection of EAs		Stage 2: Selection of HHs
Selected Bairros for the IE design	Potential treatment or control sites	No. of total Enumeration Areas (EAs)	No. of EAs to be selected	No. of HHs in selected EAs that meet the sample frame criterion	No. of HHs to be selected for baseline survey
Nampula:					
Muatala	Both	77	10	453	150
Muhala – Sede	Both	76	10	638	150
Mutauanha	Both	72	10	483	150
Namutequeliua	Both	51	10	1034	150
Muahivire	Extra control	78	20	1391	300
Total					900
Monapo:					
Mucaca	Trtmt	9	All \a	563	80
Mecutane	Trtmt	8	All	305	80
Topelane	Trtmt	7	All	383	80
Moajem	Trtmt	5	All	357	80
Boa Viagem	Trtmt	5	All	186	80
Metoprime	Trtmt	4	All	154	80
Mulotine	Cntrl	6	All	310	80
Nachicuva	Cntrl	21	5	189	80
Naheruque	Cntrl	6	All	221	80
Micolene	Cntrl	8	All	239	80
Nova Cuamba	Cntrl	9	All	695	80
Total					880

\a For bairros that had less than 10 EAs, "All" the EAs are included in a one-stage systematic selection of households.

Data collection

The evaluation will use household level surveys that will include interviewing the head of the household based on a detailed instrument. The questionnaire includes more than 25 sections encompassing modules on:

1. Household characteristics (demographic information by each member of the HH)
2. Employment and sources of any other cash transfers
3. Identification and list of all the parcels
4. Land conflicts

5. Rights to the land and perceptions of the risk
6. Parcels rented out, rented in
7. Characteristics of parcels
8. Investments on land
9. Perceptions about the DUAT, renting land and the land law
10. Relative space occupied by crops in the plot
11. Production and sales of basic food crops, cash crops, vegetables, fruits, nuts, etc.
12. Agricultural practices
13. Ownership of Assets
14. Monthly expenditures
15. Credit in the last 12 months
16. Livestock and sub-products produced and sold in the last 12 months
17. Consumption

The survey has detailed sections for each of the outcomes to be evaluated, both intermediate and final outcomes. In addition, each of the survey households will be geo-referenced. If the head of the household is not present at the time of the first visit, enumerators will attempt to make an appointment and return again to interview the appropriate person, provided that this return visit is possible within the time that the survey team will be in the area. In households that are male-headed with a spouse present, the spouse will be the respondent for the livestock and food consumption modules. The survey is designed to take between 1 and 1 ½ hours.

Survey Calendar

The survey will be implemented from October to December 2010 and will represent baseline data for this IE design. Ideally, the follow-up survey should be planned around the same time in 2013 to represent 'after' intervention data. However, depending on the contractual agreement between MCC and MSU and MCA and MINAG-DE, the follow-up survey in 2013 may occur prior to September 21, 2013 (which is the end date of the Compact Agreement).

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Annex 1

Definition of important terms and concepts in the context of the Land Project

Geographic areas: are basically "priority areas" that are facing some hot issues related to land that need urgent attention (e.g., conflict resolution, regularization, expansion, great demand that cannot be met with current capacity, etc.).

Bairros: Refer to a sub-set of a municipality with well-defined boundaries. They are similar to large neighborhoods (defined in terms of city blocks) in an urban area. These will be the unit of intervention for hotspot issues in the selected municipalities.

Villages: Refer to a sub-set of a district with well-defined boundaries in terms of inhabitants. These will be the unit of intervention for hotspot issues in the selected districts.

Hotspots: refer to (hot) issues that need to be resolved/addressed in a given geographic area. As such the geographic area to be identified for interventions may include 1-3 of the following hotspot issues.

- **Expansion:** This refers to the plan for expanding the area under a bairro based on a proper structural plan.

- **Requalification:** This is mainly a hotspot issue in urban areas that involves several steps with the end result being a restructured bairro that is properly zoned, roads are clearly marked, and each plot is demarcated and identifiable in the cadastral system with information on the name of the occupant(s), characteristics of the plot, demographics of the HH, etc.

- **Regularization:** Regularization (in the context of an urban setting) refers to the demarcation and delimitation of plots after an area is 'requalified.' Thus regularization is the follow-up step or the end result of requalification. Since the purpose of delimitation and demarcation is to register each plots in a cadastral system for potential DUATs, the municipality will not do this until they go through the 'requalification' process first.